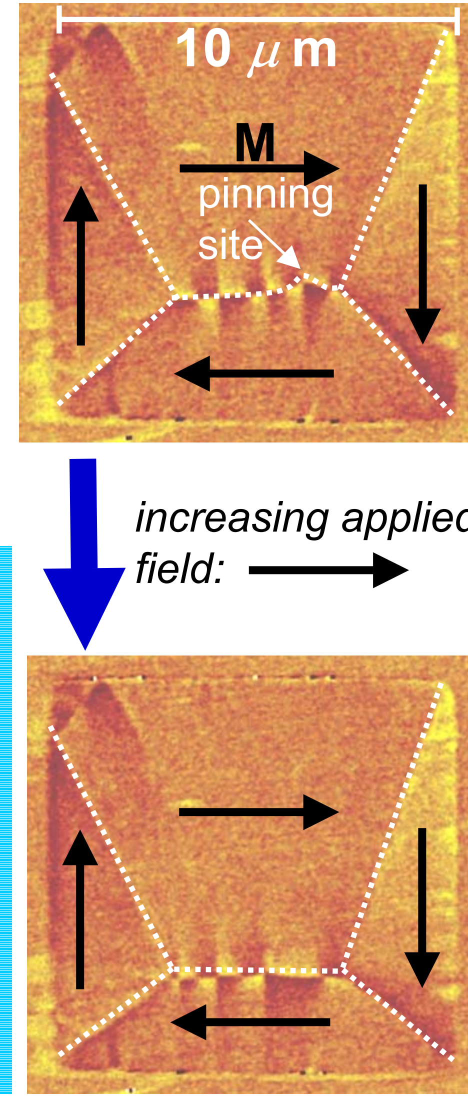
Development of Instrumentation for Teaching and Research on Thin Magnetic Film Microstructure Switching Dynamics

J. L. Erskine, The University of Texas at Austin, **DMR-0216726**

Understanding and controlling the dynamic magnetization reversal processes in micron- and nano-scale magnetic structures is critical to future technological advances in high-density magnetic information storage (magnetic random access memory; magnetic recording heads) and high-frequency telecommunications (thin-film integrated inductor cores; “metaferrites” used in microwave communications components).

This grant provided instrumentation resources to examine magnetization reversal dynamics in magnetic microstructures at the most fundamental length and time scales.



Magnetic Force Microscope (MFM) images of candidate material for next-generation recording head technology. Increasing magnetic field causes motion of “domain wall” boundary separating parallel (top) and antiparallel (bottom) domains.

Pinning sites lead to “jumps” in magnetization reversal.

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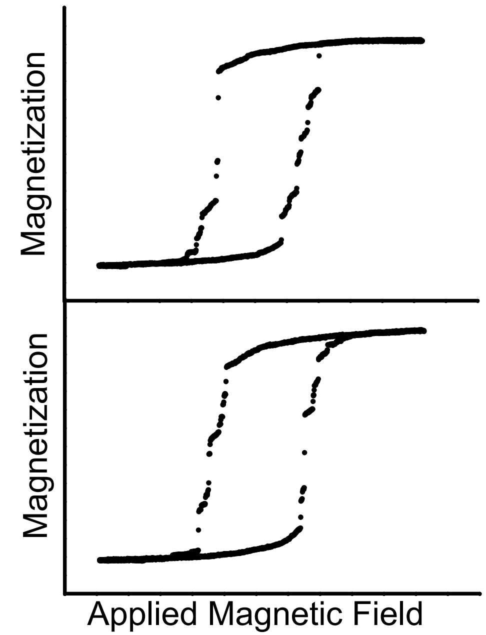
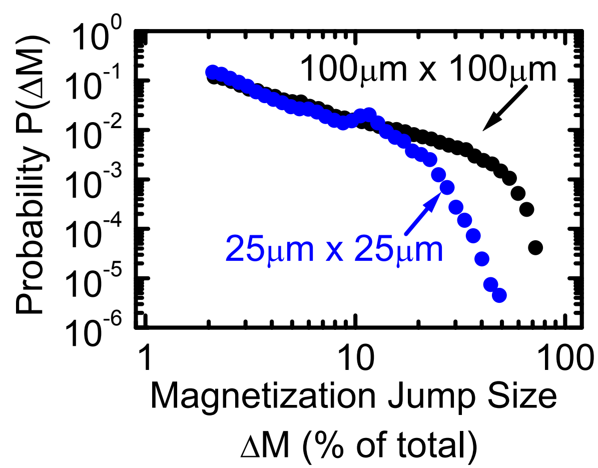
EDUCATION: A postdoctoral associate (Geoff Beach) and two graduate students (Corneliu Nistor and Shuquan Yang) are using the instrumentation provided by this grant to advance understanding of magnetic switching and magnetic energy loss in micro- and nano-scale materials. This research should lead to the development of new nanostructured composite materials for high-speed switching and high-frequency applications.





Discrete "Barkhausen" jumps in successively measured hysteresis loops in a thin film microstructure (100 μm x 100 μm) resulting from depinning of a domain wall from defect sites, and dependence of the probability distribution of the magnitude of these jumps on the microstructure size.